

### **REMARKS**

The amendment to the specification adds a clause from claim 4 included in the original application. The amendment to the specification does not add new matter.

#### **The rejection of claims 32 and 34 as lacking a written description is traversed.**

The limitation in claims 32 and 34 for a “the combustion gas outlet is **adjacent** a narrow section of the flue gas passage” is supported in the original application which describes the location of the cavity as “[t]he optimum location for the cavity is the front wall, which is opposite to the bullnose wall.” Spec. p. 3, lns. 34 to 35. Figure 1 shows the narrow section of the flue gas passage is adjacent the bullnose. Figure 1 also shows that the flue gases from the superheater cavity are discharged immediately upstream of the superheaters in the boiler. Similarly, original claim 4 states that the so that gases from the superheater cavity are discharged immediately upstream of the superheaters of the boiler.

The application describes mixing gases from the superheater cavity with flue gases in the narrow section (bull nose section) of the furnace/boiler as follows:

**The flue gases from the superheater cavity may be used to shape a flue gas flow pattern, from the furnace of the recovery boiler over the bull nose** to improve gas distribution and heat transfer into the superheaters, or to generate conditions required for emission control, such as the optimum temperature window for selective non-catalytic reduction (SNCR) to reduce NO<sub>x</sub> emissions, or for particle size growth to reduce fine particle (size less than 2.5 micrometers) emissions (Spec. p. 4, lns. 33-37, Emphasis Supplied)

Figure 1 and original claim 4, supports the new element of claim 32 requiring that gas from the cavity mix with flue gas adjacent a narrow section of the flue gas passage and immediately upstream of the at least one superheater. Accordingly, the rejection of these claims as lacking a written description should be withdrawn.

**The rejection of claims 32 and 34 as being anticipated by WO 92/18690 (WO '690) is traversed and has been overcome by amendment.**

These claims as amended require "the combustion gas outlet is adjacent a narrow section of the flue gas passage and the combustion gases from the cavity initially mix in the narrow section with flue gases passing through the narrow section." WO '690 does not disclose initial mixing in a narrow section of the flue gas passage. WO '690, in Figure 1, shows the outlet to the cavity 22 to be adjacent a wide portion of the flue gas passage and at the same elevation as the superheaters in the boiler. The text of WO '690 also does not indicate that gases from the cavity are to be mixed in the narrow section of a flue gas passage.

Independent claim 32 has been amended to require "the narrow section of the flue gas passage [to be] immediately upstream of the at least one superheater of the boiler." This amendment further distinguishes WO '690 which shows the superheating boiler (22) having an outlet (see horizontal arrow extending out of the boiler 22) that is adjacent and at the same elevation as the superheaters (72). There is no anticipation of claims 32 and 34 because WO '690 does not disclose a combustion gas outlet adjacent a narrow section of a flue gas passage and that is upstream of the superheater in the boiler.

The arrangement of a superheater chamber and boiler in WO '690 causes the flue gases from the superheater chamber to mix with the flue gas stream in the superheater section of the recovery boiler. The mixing in WO '690 does not occur upstream of the superheaters and, thus, the flue gases flowing from the superheating boiler cannot be used to shape a flue gas flow pattern at a narrow section of the flue gas passage or upstream of the superheaters. In contrast to WO '690, the invention defined by claim 32 does require the flue gases from the cavity to enter a narrow section of the flue gas passage and upstream of the superheaters. This point of entry allows the cavity flue gases to shape the flue gas stream and thereby improve the gas distribution and heat transfer of the gas flow entering the superheaters, as is described in the application at p. 4, lns. 33-37.

There is no anticipation with respect to dependent claim 34 for the additional grounds that WO '690 does not disclose water cooled tubes of the cavity wall in fluid communication with the water cooled tubes in the walls defining the furnace. WO '690 does not state at page 13, lines 27 to 30 that the walls of the cavity and furnace are water cooled tubes or that the tubes are in fluid communication.

The reference in WO '690 (page 13, lns. 26-30) to "closely connected" pressure frames for the "separate" superheating boiler and the waste liquor recovery boiler is not a teaching that the walls of both boilers are cooled with the same water circulation system. In particular, WO '690 does not state that the walls of the cavity are cooling tubes in fluid communication with water cooled walls of a boiler. Further, it is not inherent that the

walls of the superheating boiler in WO '690 are water cooled with water from water cooled walls of the boiler. Assuming that the superheating boiler of WO '690 has water cooled walls, there is no reason to believe that the cooling water for the walls of the superheater is hot water flowing from the water cooled walls of the boiler.

The superheating surfaces 72 in WO '690 are not cooling tubes forming the walls of the superheating boiler. The disclosure in WO '690 (page 16, lns. 6-14) of superheating surfaces 72 states that such surfaces are "disposed in the superheating boiler" and does not state that the surfaces constitutes the walls of the boiler. The superheating surfaces 72 may be disposed within the superheating boiler and not form the walls of the boiler. By way of example, the present application discloses a superheater 24 (IV) that is distinct from the water cooled walls of the superheating cavity. Accordingly, the disclosure of a superheating boiler in WO '690 is not a suggestion that the walls of the superheating boiler are water cooled with water flowing from water cooled walls of the boiler.

**The rejection of claims 5, 7 to 9, and 19 to 27 as being obvious over WO '690 in view of Engstrom (US Pat. 4,676,177) is traversed.**

Independent claims 5 and 19 (on which depend claims 7 to 9 and 20 to 27) require cooling tubes or water cooled walls of a superheater cavity formed of, at least partially, the cooling tubes or water cooled walls that receive cooling fluid from the water/steam circulation system for the walls of the recovery boiler. These claimed elements are stated as:

- a “cavity having cavity walls formed of water cooled tubes in fluid communication with the water cooled tubes in at least one of the walls of the boiler and the water or steam circulation system, wherein at least a portion of the water cooled tubes of the at least one cavity is formed of the water cooled tubes of the walls of the boiler.” (Claim 5).
- “cooling a cavity wall of the cavity by flowing the cooling fluid from the wall of the boiler through the wall of the cavity, wherein the cavity wall having cooling fluid is at least partially formed of the wall of the boiler.” (Claim 19).

WO ‘690 does not disclose walls of a cavity that are: (1) cooled with the same water circulating through the walls of the boiler or (2) having water cooling tubes that are at least partially formed of the walls of the boiler. There is no suggestion in WO ‘690 that the superheating boiler and waste liquor recovery boiler share water cooled tubes or water cooled walls.

The Action at page 4 describes WO ‘690 as disclosing “walls of the boiler further comprising a plurality of water cooled tubes in fluid communication with the water or steam circulation system.” Contrary to the Action, WO ‘690 at page 13, lines 27 to 30 states that the separate superheating boiler and the waste liquor recovery boiler may have “pressure frames [that] are closely connected to each other, for instance by some kind of precombustion chamber construction.” WO ‘690 does not disclose water cooled walls of

the waste liquor recovery boiler that are in fluid communication with the walls of the superheating boiler.

Engstrom is applied in the Action at page 6 as teaching that “at least a portion of the ...of the cavity walls is formed of the ... of the at least one of the walls of the boiler.” However, Engstrom has no cavity. The claims require a recovery boiler having a furnace where liquor is burned to produce flue gases and a cavity where another fuel is combusted. In the claimed arrangement, the pressure and the operating temperature of the steam recovered from the waste liquor recovery process is increased by the superheater cavity, whereby the overall electrical efficiency of the plant is improved, i.e. more power is generated by the heat recovered in the steam.

Engstrom has one combustion chamber (furnace) in which the product gas from the gasifier 1 is burned in a combustion chamber 13 of the boiler 4 at oxidizing conditions. Melt and solid ash are drained through the bottom of the boiler and collected. The flue gases pass through a convection section 14 of the boiler, in which heat energy is recovered in the form of steam. A major fraction of the molten solids is removed from the flue gas stream by the sharp turn in gas flow, via the slag tap at the bottom of the boiler. Engstrom does not suggest and is unrelated to an “additional” combustion chamber arranged in the recovery boiler.

The combination of WO ‘690 and Engstrom do not form the claimed invention. In particular, there is no disclosure in WO ‘690 and Engstrom of water cooled walls in a

cavity that are formed of water cooled walls in a furnace or of such walls being in fluid communication.

The Action at page 7 states that “applicant is using the known technique of providing a common wall between the combustion chamber and the boiler to improve similar devices in the same way.” This statement does not address the requirement of the claims that the walls of the boiler and the walls of the cavity be in “fluid communication.” In view of the lack of such a disclosure in WO ‘690 and Engstrom, the combination of the references could not have lead a person of ordinary skill in the art to arrange walls between a combustion chamber and a boiler that are in fluid communication.

The dependent claims are patentable for at least the following reasons:

- WO ‘690 does not expressly or inherently a plurality of superheaters as called for in claim 12.
- WO ‘690 does not expressly or inherently teach forming the superheater from water cooled tubes of the walls of the boiler, as called for in claim 5 and claim 13.

**The rejection of claims 5, 7, 9 to 12, 14, 15 and 18 as being obvious over Hamm (US Patent 2,606,103) in view of Engstrom is traversed for the same reasons as stated above for the independent claims on which these claims depend.**

Hamm does not disclose a superheating cavity having walls formed of water cooled tubes and does not disclose that water from a boiler feeds such non-existent water

cooled tubes. In Hamm, the walls of the second furnace D are made of a refractory material (“refractory walls 12) and cooled by air. Hamm, col. 5, ln. 60 to col. 6, ln. 3. The lack of water cooled walls in Hamm would have lead a person of ordinary skill away from the claimed invention that involves water cooled walls and coupling of water cooled walls in a cavity and in a furnace.

Contrary to the rejection, tubes 16, 17, 27 and 10 in Hamm are not water cooled walls. Tubes 16, 17, 27 and 10 form the super heaters in the second furnace D and recovery furnace. Hamm, col. 5, lns. 40-45. Hamm also does not disclose:

- a “cavity having cavity walls formed of water cooled tubes in fluid communication with the water cooled tubes in at least one of the walls of the boiler and the water or steam circulation system, wherein at least a portion of the water cooled tubes of the at least one cavity is formed of the water cooled tubes of the boiler.” (Claim 5).
- a “cavity separate from the furnace and having walls formed of water cooled tubes, wherein fluid flowing through the water cooled tubes of the wall defining the furnace flows through the water cooled tubes of the cavity and to the at least one superheater, and wherein at least a portion of the water cooled tubes of the at least one cavity are part of the water cooled tubes of the walls of the boiler.” (Claim 10).
- “cooling a cavity wall of the cavity by flowing the cooling fluid from the wall of the boiler through the wall of the cavity, wherein the cavity wall



having cooling fluid is at least partially part of the wall of the boiler.”

(Claim 19).

- a plurality of superheaters as called for in claim 12.
- forming a superheater from water cooled tubes of the walls of the boiler, as called for in claim 5 and claim 13.

The combination of Hamm and Engstrom would not have lead a person of ordinary skill to use water cooled walls, because these references do not teach the use of water cooled walls in fluid communication. Hamm teaches away from water cooled walls. Engstrom is largely silent regarding water cooled walls. These references do not provide a suggestion to a person of ordinary skill to arrange water cooled walls that are in fluid communication.

The Advisory Action states that WO ‘690 in combination with Ham disclose or teach limitations as claimed and that the applicant is using the known technique of providing for a common wall between the cavity and the boiler. Ham does not show a common wall between the superheater furnace D and the recovery furnace A. Ham shows a horizontal flue duct 11 extending from furnace D and openings in the side wall of the recovery furnace A (col. 5, lines 5 to 23) through which the flue gases from furnace D can flow to the recovery furnace A. The horizontal flue duct 11 in Ham is inconsistent with common wall between a cavity and a boiler.

**The rejection of claims 28 to 30 for obviousness over WO ‘690 in view of Olausson (US Pat. 5,454,908) is traversed for the reasons stated above.**

WO '690 does not disclose the elements of amended claim 28 of: "the injection of the hot combustion gases from the cavity mixes, in the narrow portion, with the flue gas in the flue gas passage as the flue gas flows past the narrow portion."

WO '690 does not disclose mixing in the narrow section of the flue gas passage of the furnace. WO '690, in Figure 1, shows the cavity 22 to be above and downstream of the a narrow section of the furnace 18. The text of WO '690 also does not indicate that gases from the cavity are to be mixed in the narrow section of the furnace with flue gases.

Olausson describes a method for obtaining fumes having a low content of nitrogen oxides during the combustion of black liquor in recovery boilers. In this method a part of the combustion air is fed as a last portion at a very highly located level so that a reducing atmosphere without extra addition of reduction gases exists from the area of the input of the black liquor to the last air addition for a period of at least 3-5 seconds. Olausson does not teach selective non-catalytic reduction (SNCR) or improving mixing by adding a flue gas stream at a certain location in the furnace of the recovery boiler.

The combination of WO '690 in view of Olausson does not suggest mixing of combustion gases from a cavity with flue gases at a narrow section of the furnace, as is recited in the amended claims. These references do not provide any reasons as to why a person of ordinary skill would mix gases from a cavity with flue gases at a narrow section of a furnace/boiler.

Further, the dependent claims would not have been obvious because the combination of WO '690 and Olausson do not teach:

- That hot combustion gases from the cavity are injected into an opening on a sidewall of the flue gas passage opposite to the bull nose section as required by claim 29.
- That the injection of the hot combustion gases from the cavity shapes the flue gas so as to flow over the narrow portion and into an expansion portion of the flue gas passage above the narrow portion, as required by claim 30.

**The rejection of dependent claim 33 for obviousness over is traversed for the same reason as stated above for claim 32 and 28 to 31.**

**The rejection of claims 28 to 30 for obviousness over Ham in view of Olausson is traversed.**

Independent claim 28 is amended to defined the “narrow portion” as being adjacent the bullnose in the wall of the boiler. This amendment distinguishes Hamm that discloses a furnace having a uniform area flue gas passage.

Hamm does not disclose mixing flue gases with gases from a cavity in a narrow section of a furnace. Further, Olausson does not teach adding a flue gas stream at a certain location in the furnace of the recovery boiler. The combination of Hamm and Olausson does not disclose the mixing of gases from a cavity with flue gas in a narrow portion of the furnace. Accordingly, the combination of the references would not have rendered the claimed invention to have been obvious.

**The rejection of claims 32 to 34 for obviousness over Hamm in view of Olausson is traversed.**

Hamm does not disclose a superheating cavity having walls formed of water cooled tubes and does not disclose that water from a boiler feeds such non-existent water cooled tubes. In Hamm, the walls of the second furnace D are made of a refractory material (“refractory walls 12) and cooled by air. Hamm, col. 5, ln. 60 to col. 6, ln. 3. The lack of water cooled walls in Hamm would have lead a person of ordinary skill away from the claimed invention that involves water cooled walls and coupling of water cooled walls in a cavity and in a furnace. Further, Olausson does not teach adding a flue gas stream at a certain location in the furnace of the recovery boiler. The combination of Hamm and Olausson does not disclose the mixing of gases from a cavity with flue gas in a narrow portion of the furnace. Accordingly, the combination of the references would not have rendered the claimed invention to have been obvious.

The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed

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herewith (or with any paper hereafter filed in this application by this firm) to our Account  
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Respectfully submitted,

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